Device for screwing caps onto containers

Description

The invention relates to a device for screwing caps onto containers in accordance with the introductory portion of claim 1.

Such a device is already known, in which the activation of the gripping tongs for the closures is carried out by means of a stationary control curve in which curve rollers revolving on a circular track engage with the gripping tongs (SU-PS 1 736 915). Because of the max. permissible gradient of the curve, the time for the closing- and opening movement of the gripping tongs is thereby relatively great, which stands in the way of high capacities. A change of the closing- or opening position of the gripping tongs, as the case may be, requires a time-consuming replacement of the control curve. In addition, the manufacturing and assembly of the control curve is very cost-intensive, because its course must be precisely adjusted to the course of a second control curve, which defines the lifting movement of the closing heads.

The task which forms the basis for the invention lies in creating a device for screwing caps onto containers in which it is possible to control the gripping tongs without a stationary lifting curve, and which makes possible a rapid and variable reversal of the gripping tongs.

This task is solved in accordance with the invention by means of the characteristics stated in claim 1.

In one device in accordance with the invention, a precise and rapid reversal of the gripping tongs is carried out -- entirely without a stationary control curve -- by means of control units revolving with the closing heads in connection with the stationary stops. The stops themselves can easily be reversed, and can also be easily accommodated in sterile rooms.

One particularly simple and reliable reversal is brought about if, in accordance with one additional development of the invention, the closed position and/or the open position of the control units is stabilized in a self-limiting manner.

Various possibilities are conceivable for the construction of the control units. The configuration in accordance with the sub-claims 3 to 5 is particularly preferred.

Two examples of implementation of the invention are described in the following by means of the diagrams. These depict the following:

Figure 1: A lateral view of a closing head with the gripping tong opened, in a partial cross-section;

Figure 2: A partial lateral view of a closing head in accordance with Figure 1, with the gripping tong closed;

Figure 3: A partial lateral view of a closing head with a modified control unit, with the gripping tong closed;

Figure 4: A vertical section through the closing head in accordance with Figure 3;

Figure 5: A view from above of the closing head in accordance with Figure 1;

Figure 6: A view from above of an additional design of a device for screwing on caps;

Figure 7: The section A - B in accordance with Figure 6.

The device in accordance with the figures 1, 2 and 5 is designed for the screwing of sealing caps (V) of plastic, which are provided with an internal threading, onto containers (G), in the form of PET bottles for beverages. It has a rotor (1) revolving around a vertical rotational axis (D), on which [rotor] several closing heads (2) are positioned distributed uniformly over the circumference, which [heads] revolve on a circular track (K).

Every closing head (2) is supported in a rotatable manner in a horizontal bearing bracket (10), which [bearing bracket] is, for its part, attached to a vertical column (11). This is accommodated in the rotor (1) in a controlled, height-adjustable manner by means of a lifting curve, not depicted, as indicated by the double arrow (12). An electrical servomotor (13) is additionally attached to the bearing bracket (10); this motor sets the closing head (2) into rotation by means of toothed wheels (14, 15, 16) at predetermined areas of its circular track (K), with the rotor (1) having a predetermined rotational speed and a predetermined torque.

Each closing head (2) has, on its lower end, a gripping tong (3) for each cap (V), which is constructed of several, particularly three, gripping arms (17, 18) which are similar to double levers. The gripping arms (17, 18) can be swiveled around horizontal axes (19, 20), and are provided on the lower end with gripping jaws (21, 22) for a cap (V). On the upper end, the gripping arms (17, 18) have curve-shaped oblong holes (23, 24) with which bolts (25, 26) engage. These are attached to a control head (27) which is supported in the closing head (2) in a height-adjustable manner by means of a bar (28). A compression spring (29) which is supported on the lower end directly on the closing head (2), and on the upper end on a sleeve bushing (30) attached to the bar (28), is positioned on the vertical bar (28). The compression spring (29) thus pushes the control head (27) into its upper end position, which is depicted in Figure 2, in which the bolts (25, 26) close the gripping tong (3), or keep it closed by means of the oblong holes (23, 24). A cap (V) is thereby solidly clamped between the gripping jaws (21, 22), so that it can be screwed onto a container (G) by means of the closing head (2), which is driven by means of the servomotor (13). For this purpose, a container holder (31) is attached to the rotor (1) underneath every

closing head (2), in which [holder] the container (G) is clamped in a non-rotating manner.

Concentrically to the bar (28), a push rod (8) is supported in the closing head (2) in a height-adjustable manner. This is supported by means of a ball bearing (32) on the bar (28), so that a rotational movement relative to this is possible. Towards the top, the push rod (8) projects a small distance out of the closing head (2). In this area, a control unit (4) for the gripping tong (3) acting on the push rod (8), in the form of a cam (7), is supported rotatably on a vertical axis (33). The axis (33) is displaced laterally to the push rod (8), which is likewise positioned vertically, and is attached to a U-shaped support block (34), which block, for its part, is attached to the upper side of the bearing bracket (10). The control unit (4) thus participates in both the height movement of the bearing bracket (10), and thereby of the closing head (2), as well as in the rotational movement of the same on the circular track (K) around the rotational axis (D).

The cam (7) of the control unit (4) is constructed as a spatial curve and is formed in such a manner that, in the opening position depicted in Figure 3, it presses the push rod (8) and, by this means, the bar (28), into its lower end position. As has already been described, the gripping tong (3) is thereby opened or held open, as the case may be, and can thus be lowered onto a cap (V) which is to be grasped. The caps (V) are distributed under the closing heads (2) in the usual manner by means of a supply unit (35).

In addition, the cam (7) of the control unit (4) is formed in such a manner that, in the closed position depicted in Figure 2, it releases push rod (8), so that the bar (28) can, under the influence of the compression spring (29), occupy its upper end position. By this means, as has already been described, the gripping tong (3) is closed or held closed, as the case may be, so that a cap (V) grasped by the gripping tong (3) can be screwed onto a container (G).

The opening position of the control unit (4) is displaced by approx. 90 degrees relative to the closed position. Both positions are stabilized in a self-limiting manner by means of the bearing friction on the axis (33) (closed position) and by means of the friction between the cam (7) and the push rod (8), which is caused by the compression spring (29) (opening position).

Each control unit (4) additionally has an angle lever (9) on the upper end, which [lever] is non-rotatably connected with its cam (7). This cooperates with two bolt-shaped stops (5, 6), which are stationarily positioned on the columns (S) on the circular track (K) of the closing heads (2). The first stop (5) reverses the direction of the gripping tong (3) from the opening position depicted in Figure 1 into the closed position depicted in Figure 2, shortly after this has been placed onto a cap (V). The second stop (6) reverses the gripping tong out of the closed position depicted in Figure 2 and into the opening position depicted in Figure 1, shortly after the cap (V) has been completely screwed onto the container (G). The second stop (6) is depicted in Figure (5) in dotted lines because it is, in fact, located at a greater distance from the first stop (5).

The closing head (2') in accordance with Figures 3 and 4, with the exception of the control unit (4'), corresponds most completely with the closing head (2) in accordance with Figures 1 and 2. Corresponding parts are marked with the same reference figures and the supplemental mark ('). Only deviations are described in the following.

In the closing head (2'), the control unit (4') is supported rotatably on its axis (33'), concentrically to the push rod (8'). The push rod (8') supports a horizontal bolt (36) on its upper end, which [bolt] projects out of the push rod (8') on both sides. One roller (37) each, which cooperates with the cam (7') of the control unit (4'), is non-rotatably supported on the ends of the bolt (36) that project out. Through this fact, better friction conditions result than with direct contact between the push rod (8) and the cam (7) of the closing head (2). Furthermore, a better self-inhibition is possible through the fact that slight depressions (38) are incorporated into the cam (7'), into which [depressions] the rollers (37) are pressed under the influence of the compression spring (29'). The bolt (36) is guided into oblong holes of the support block (34'), and thus does not participate in the rotation of the closing head (2').

The device in accordance with Figure 6 and 7 only differs from the device in accordance with Figure 3 and 4 through the configuration of the control unit (4") and the stationary stops cooperating with the same (5' and 6'). The control unit (4") here has a horizontal lever (38), on the upper side of which two concentric curve rollers (39) are positioned in a rotatable manner with a vertical rotational axis.

The stationary stops (5' and 6') for the opening or closing of the gripping tong (3), as the case may be, each have one horizontal plate (40, 41) here, on the lower sides of which slot curves (42, 43) are formed. The slot curves (42, 43) each have starting- and ending areas proceeding tangentially to the circular track (K), as well as a middle area proceeding obliquely to the circular track (K). The tangential areas make possible an intake and release of the curve rollers (39) free of impact, while the oblique middle area brings about the rotation of the lever (38), and thereby of the control unit (4"), by approx. 85°.

By this means, an abrasion-free and smooth course of the reversal of the gripping tongs (3) is brought about, even at high outputs. The slot curves (42, 43) only extend over a small portion of the circular track (K), and are positioned on the column (S) in such a manner that they can be adjusted independently of one another. Favorable manufacturing costs, as well as a simple adjustment to the operating conditions, result from this.